REMARKS/ARGUMENTS:

Claims 1-24 remain pending in the patent application, Claims 1, 17, 18, 21 and 23 were further amended.

Claims 23 and 24 were rejected under 35 USC 102(b) as being anticipated by Grob (Injection techniques in capillary GC). Claims 1, 2, 4-9, 10, 12, 13, 17, 19, 21 and 22 were rejected under 35 USC 103(a) as being unpatentable over Grob (Injection techniques in capillary GC) in view of Heikklia et al. Claims 3, 14, 16 and 18 were rejected under 35 USC 103(a) as being unpatentable over Grob (Injection techniques in capillary GC) in view of Heikklia et al. and further in view of Grob et al. (6,451614). These rejections are traversed.

The independent claims 1, 17, 21 and 23 were further amended to use the term "tip" in identifying the exit port of the needle of a syringe as opposed to the terms "exit" or "free end". Claim 1 was further amended with subject matter found in claim 17 as concerns an unheated or cooled upper portion of the vaporization chamber and as concerns the needle being arranged to inject a sample liquid through a tip of the needle into the upper portion of the vaporization chamber to release the sample liquid in a form of a liquid band. Claims 17 and 23 were further amended to recite that a distance between the tip of the needle and the liquid stop means being greater than 55 mm. Claim 18 was amended accordingly to avoid redundancy with the language amended into claim 17. Claim 21 was amended to recite that concept of an unheated or cooled upper portion of the vaporization chamber. Claims 1, 17, 21 and 23 were further amended to define that the upper portion of the vaporization chamber maintains the

released sample in the form of the liquid band, as mentioned in the patent application on page 10 lines 6-7.

In view of the suggested amendments in Claims 1, 17 and 23, it is believed that the independent Claims 1, 17, 21 and 23 are novel and unobvious over the cited prior art. The cited documents do not disclose or hint at the features of Claims 1 and 24.

The Examiner is referred to page 5, lines 5-27 of the description of the application where the present invention is summarized. The present invention exploits the well known so-called Leidenfrost phenomenon disclosed also by Grob in "Injection Techniques in Capillary GC" cited by the Examiner (see page 1012A of said publication from last paragraph of middle column to lines 10 of right column). According to the Leidenfrost phenomenon, the liquid sample is injected into a hot vaporization chamber, the temperature of which cannot be lower than the boiling point of the liquid sample. After injection, **a small quantity of solvent evaporates** on the liner wall of the vaporization chamber **and forms a cushion repelling the liquid** sample, thus the liquid sample is guided towards the center of the liner and it travels as such downwards. The inventors of the present application recognized that the vaporization chamber can be elongated, *i.e.*, its capacity can be increased by applying the Leidenfrost phenomenon under the conditions set forth in the independent Claims 1, 17, 21 and 23 of the present invention which enables the injection of samples having large volumes. None of the cited prior art teaches or hits at the features of said independent claims in combination with the distance between the tip of the needle and the stopping or vaporization means in a vaporization chamber. This elucidation was intended for the Examiner's information.

Regarding the prior art cited by the Examiner, it is to be pointed out that what affirmed at page 2, point 3 of the Office Action about the teachings of the Grob reference cannot be found in the reference.

Actually, Grob (Injection techniques in capillary column) summarizes briefly the commonly known injection techniques. In particular, Grob emphasizes that in programmed temperature vaporizing (PTV) split injection, the sample is **introduced into a cool chamber, which is rapidly heated after the syringe needle is withdrawn** (see page 1009, right column and Fig. 1a). Grob discloses only the cooling of the septum where the needle is introduced into the vaporization chamber in order to avoid any evaporation within the needle. However, when the needle is withdrawn, the vaporization chamber is immediately heated to the vaporization temperature of the sample.

PTV injection does not suit the technique in the present application because the sample liquid would be transferred to the cool liner wall.

According to the present invention, the liner will must be clearly above the solvent boiling point, such that vapors formed on approaching sample liquid repel the liquid and guide it to the stopping means at the bottom of the vaporization chamber.

Grob points out that PTV splitless injection requires a fully packed insert within the vaporization chamber (see Fig. 1b) in order to analyze sample with large volumes. Notwithstanding, it is underlined (see page 1010 left column, lines 14-16) that said injection technique does not lead to precise reliable results (see also page 1010, right column, lines 11-13).

For injection into permanently hot injectors, the needle is always introduced into the middle or into the lower portion of the vaporization chamber in the vicinity of the entrance of the GC column (see Figs. 1-7). It is explicitly states on page 1014, right column, lines 37-52 that in splitless injection a long syringe needle is required in order to place the center of evaporation near to the column entrance. If the needle is not long enough, namely if the needle does not reach the center of the chamber, the nebulized sample does not make efficient use of the volume of the vaporization chamber and expands backwards into the carrier gas supply line and the septum purge outlet, *i.e.*, is usually lost for the analysis.

Contrary to the teaching of Grob, the present invention suggests the introduction of a needle into a vaporization chamber in such a way to obtain that the tip of said needle be at a distance of more than 55 mm from a stopping means and, furthermore, the cooling or non heating of the upper portion of the vaporization chamber where the needle is inserted. While previous concepts were based on transporting the sample near the column inlet through the needle, the present invention makes use of the observation that a band of liquid released from the needle tip may travel on its own through a hot tube over a rather long distance. Therefore, according to the present invention, the sample is **injected into the vaporization chamber in form of a liquid band** (no nebulization) and said liquid band **reaches in unaltered form the stopping means where it vaporizes.** In fact, the injected liquid band (sample) is guided to the stopper by means of the very small vapor layer formed on the hot liner wall (inferior portion of the chamber is heated). Movement **of the sample in form of a liquid band enables** the elongation of the vaporization chamber, *i.e.*, a relatively **great distance**

between the needle tip and the stopping means, which is at least 55 mm, never discussed or hinted at by any of the known prior art. It enables a longer vaporization chamber with a correspondingly higher capacity for sample vapor. This was considered impossible to achieve in said Grob publication (Injection techniques in capillary GC).

The present invention permits the analysis of samples having large volumes in a reliable manner without recording overflow losses as known from the prior art.

Regarding the other cited US patent documents, Heikkila et al (US 4,628,726) deals with a liquid chromatographic analysis for determining the concentration of organic composition analyses, breakdown products and organic contaminants in plating baths. The sample is introduced as a liquid into a liquid chromatographic system (HPLC), where the sample is separated into its constituting components on a chromatographic analytical column and measured by a detector. Gas chromatography and liquid chromatography are totally different techniques.

It is evident that Heikkila et al has nothing in common with the present invention; it **cannot suggest the dimensions of a vaporization chamber for a gas chromatographic apparatus**, simply because no vaporization chamber exists.

Grob et al (US 6,451,614) discloses a method and device for vaporization injection where a short needle is used for the introduction of a sample into a vaporization chamber. **The needle is heated along its whole length in order to obtain the imminent nebulization of the sample upon its injection into the vaporization chamber.**

The needle is short in order to minimize losses of high boiling compounds and must be strongly heated such that the partially evaporated solvent acts as a propellant. Nebulization (thermospray) has advantages for the evaporation of sample components, but it does not enable the transport over long distance to the column and, therefore, the length of the vaporization chamber is limited by the length of the syringe needle.

Such a method is completely different from the present invention where the injected sample travels in form of a liquid band over a rather long distance to a stopping means, enabling thereby the use of a long vaporization chamber of high capacity, such that even in the case of samples having large volume, the losses due to overflow known from the prior art can be avoided.

CORRESPONDENCE AND FEES:

In the event that there are fees necessitated by this response, authorization is hereby given to charge Deposit Account No. 03-3839. Please address all correspondence to Intellectual Property Docket Administrator, Gibbons, Del Deo, Dolan, Griffinger & Vecchione, One Riverfront Plaza, Newark, NJ 07102-5496. Should there be any questions or other matters that may be resolved by a telephone call, the Examiner is invited to contact the applicants' undersigned attorney at the number below. Any communications should be sent directly to him at the number below.

Respectfully submitted,

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